

Observations on the Behavior of the Bee *Anthidium manicatum* (L.)

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Abstract: Collection records of the Palaearctic bee *Anthidium manicatum* (L.), reported by Jaycox in 1967 as being adventive in the United States, are brought up to date. New flower host records are included. European literature on the aggressive behavior of the male is briefly summarized. Observations on the behavior of *A. manicatum* in 1965 and 1966 show the male to be territorial and aggressive. The female works without hindrance while other species of bees are struck and driven from the territory being patrolled by the male. No bees showed any inclination to defend themselves against the attacking male of *A. manicatum*. It is believed that *A. manicatum* is a rather unique subject for further study, including distribution, behavior, nest building, flower preferences and genetics.

Jaycox (1967) reports the presence in the United States of the Old World bee *Anthidium manicatum* (L.) (Megachilidae) based on specimens collected by Dr. Roger A. Morse and the writer in 1963, 1964, and 1965. *A. manicatum* is found throughout Europe, part of Asia, and North Africa. It is the only species of *Anthidium* found in England. As mentioned by Jaycox, *A. manicatum* has recently been found in the Canary Islands and in South America.

The specimens seen in 1963 were reared by Dr. Morse from a five inch deep, one quarter inch diameter trap nest in a white pine block, placed in the field early in 1963 near Ithaca, N.Y. The wooden block containing the nest was removed from the field on 27 June 1963; on 20 August 1963, adults, 2 ♂♂ and 8 ♀♀, emerged from the nest. All specimens collected by the writer in 1964 and 1965 were taken, as reported by Jaycox, from the flowers of *Caryopteris* × *clandonensis* at Ludlowville, N.Y.

In 1966, *A. manicatum* was again found at Ludlowville, N.Y. visiting the flowers of *Caryopteris*. Specimens were observed between August 28 and October 3 with peak abundance during the second week of September. It was noted in 1964 and 1965 and again in 1966 that *A. manicatum* visited only the flowers of *Caryopteris* although *Chrysanthemum* and *Potentilla* were interplanted with the *Caryopteris* and were in bloom during the flight period of the bee. Two species of *Mentha* in bloom nearby were attractive to other species of wild bees but were not seen to be visited by *A. manicatum*.

Also in 1966, a total of 13 ♀♀ and 15 ♂♂ were taken on the Cornell Campus at Ithaca on various dates between August 23 and September 2 by Jan Nowakowski, Paul Minacci and George Strang from a bed solidly planted to blue flowering salvia (*Salvia farinacea*). Dr. Nowakowski informs me that none were taken from adjoining beds planted to white salvia (*S. farinacea*) and red salvia (*S. splendens*). Also on the Cornell Campus, Dr. Nowakowski took 3 ♀♀ and 1 ♂ from *Lythrum salicaria* on August 16 and a single ♀ from

Solidago on September 12. Dr. Nowakowski noted aggressive actions against other bees by the males of *A. manicatum* he collected from *salvia*.

It is of interest, although possibly of little significance, that during a three year period all but one specimen of *A. manicatum* were collected on blue or purple flowers and all but five specimens from the rather closely related families Labiatae (*Salvia*) and Verbenaceae (*Caryopteris*). Friese (1898) says *A. manicatum* prefers Labiatae in Europe but there is no general agreement by other workers on this. It also raises the question of why plants of *Mentha* (Labiatae) in full bloom were ignored at Ludlowville.

Unfortunately no notes were made on the structure of the nest from which specimens were reared by Dr. Morse in 1963. None have been found in trap nests in subsequent years. Very likely the nest is made from soft flocculent material scraped from plants as reported in Europe. Fabre refers to nests of the group to which *A. manicatum* belongs as "—quite the most elegant specimen of entomological nest building" and Friese calls them "wunderbaren Nestbau." In 1965 the writer observed a female stripping the pubescence from the flower stem of a potted geranium (*Pelargonium*), probably with the intent of using it as nesting material.

No collections of adults have been made in New York before August. However, the specimens reared in August 1963 by Dr. Morse came from a trap nest placed in the field early in 1963 and completed by June 27. This may indicate that *A. manicatum* has two broods.

Green (1921) in England seems to have been the first to note the aggressive habits of *A. manicatum* males when he reported it attacking *Bombus*.

Ward (1928), also in England, published detailed observations on attacks by males of *A. manicatum* on bumble bees (*Bombus*) and hive bees (*Apis*). He indicates that definite territories were marked out when he states, "—males patrolling patches of Red Dead Nettle at two spots and having the effect of keeping other insects away; but a few yards away Bumble Bees feeding fairly regularly at the Dead Nettle with little or no molestation." He noted that aggression declined when the sun was obscured by clouds. Ward also found that some individuals of bumble bees and honey bees had their wings damaged so they could not fly when struck by *A. manicatum*.

In spite of Ward's detailed notes, Perkins (1928) regarded the attacks on other bees as "an accidental occurrence."

Sitowski (1947) in Poland reports that the male of *A. manicatum*, "—hovers in an area, or patrols where the female is working and kills or drives out all competing intruders with ferocious attacks." He states that not only is the competing bee knocked to the ground but that the male *A. manicatum* may continue its attack on the ground using its mandibles, and abdominal spines on the last two abdominal segments, to disable or kill honey bees and bumble bees.

The observations of Haas (1960) in Germany are similar to those of Ward. He regards the territory established by the male as part of a behavior pattern which involves swarming. The territory itself he believes to be sort of an exclusive swarming area in which the male as Haas puts it, "swarms alone."

The writer first observed the male of *A. manicatum* attacking other bees on 14 September 1965. An abstract of notes taken on that day follows:

14 SEPTEMBER 1965 In addition to honey bees, bumble bees and a few other native bees, two female *Anthidium manicatum* were present most of the day on *Caryopteris* flowers. The females were distinguished by their very fast flight and by being easily disturbed and alarmed; when disturbed by anything other than another bee they would leave the area and not return for some time. The females were far from aggressive. If one started to land on a flower and found it occupied by another bee, it would go to another flower. A bumble bee once pushed a female from a flower; the female flew to a leaf where it remained motionless for almost three minutes, then preened its legs and antennae for half a minute and then flew to another *Caryopteris* flower on a different plant.

The male *A. manicatum* moved very rapidly. It would work a flower for a second or two but it spent most of its time patrolling the largest *Caryopteris* plant. It was very aggressive and would strike honey and bumble bees which were working flowers, knocking them from the flowers. The male frequently would strike two or three bees in as many seconds. On one occasion the writer frightened the male and it flew away for several minutes. In its absence, two bumble bees and three honey bees moved to the *Caryopteris* plant which had been patrolled by the male *A. manicatum*. On its return, the male immediately struck all five bees almost faster than the eye could record, the whole episode being over in five seconds or less with all five bees in flight.

Observations were made on two successive days in 1966. The area under observation involved one large (56 in. high, covering an area of 18 sq. ft.) *Caryopteris* and a group of smaller (42 in. high, covering an area of 14 sq. ft.) *Caryopteris* plants separated by a pink flowering *Chrysanthemum* plant 23 in. high, covering an area of 3.5 sq. ft. The notes made on these two days follow:

10 SEPTEMBER 1966 One male and one female appeared at approximately 9 A.M. During the day only one female was observed at any one time and apparently only one specimen was involved. The first male to appear was very dark and is referred to as No. 1. A second male with more extensive yellow markings appeared shortly on the smaller *Caryopteris* and is referred to as No. 2. Male No. 1 spent most of its time patrolling the large plant. Occasionally male No. 2 would extend his patrol of the smaller plant into the patrol area of male No. 1. Male No. 1 would immediately drive No. 2 away. On one occasion when No. 1 had pursued No. 2 to the outer side of the smaller plant, No. 2 turned and faced No. 1. Both males hovered about two inches apart, gradually descending toward the ground; at about four inches from the ground hovering continued at essentially one place for about half a minute; then No. 1 struck No. 2 head on knocking it to the ground beneath the plant where it remained with wings partly outstretched and with the apical third of the abdomen vibrating. Male No. 2 remained on the ground about three minutes and then it flew away. It was not seen again.

Following this episode, male No. 1 rarely left the large *Caryopteris* all day. Occasionally it would make a quick patrol of the group of small plants formerly patrolled by No. 2. It had a regular route around and through the large plant and conducted its patrol by hovering a second or two and then flying four to six inches. All bees except female *A.*

manicatum were driven away. Usually it would strike the center of the thorax, possibly because this was the usual aspect exposed; it was seen once to strike a bumble bee head on and once struck a bumble bee from below. Rarely a very small bee would manage to visit a flower and be overlooked by the male but usually it would be struck as soon as it tried to move to another flower. All bees, including the largest bumble bees, appeared to be panic stricken when struck by the male *A. manicatum*; none made any attempt to fight back and only one, a large *Xylocopa*, was noted to require two strikes. Bumble bees slowly flying by the plant were sometimes struck and immediately put on an amazing burst of speed.

The male rarely bothered the female. Several times it landed on the dorsum of the female giving the impression it was trying to mate. It could not be determined if mating took place but the contact would sometimes last for eight to ten seconds. During contact the female would keep working the flower but once the pair fell from the plant, separating before they reached the ground.

A bumble bee was killed with cyanide and immediately pinned to a flower in a natural position. The male *A. manicatum* did not strike it but circled it twice about one half inch away; from then on it was ignored by the male on his patrol except at rare intervals when it would fly very close to the pinned bee. When the bumble bee was moved to another flower, it continued to be ignored.

A bumble bee was quieted with DDVP and tied to a blossom while still moving its wings. It was struck by the male as it was being tied but was ignored from that time on except for a rare quick investigation. At the same time the male was striking all intruding bees.

It was noted that during the heat of the day the male was extremely aggressive and spent very little time on flowers and none resting. After 5 P.M. it made many stops probing flowers although each stop was only of a few seconds duration. It also would rest for five to eight seconds on foliage. At this time of day it was not quick to strike intruders but it did strike them eventually. This may have been due to lower temperature, weariness, or the need to secure some nectar to sustain itself.

11 SEPTEMBER 1966. The activities of male No. 1 were about the same as noted on the previous day. It now took over the smaller plants patrolled by No. 2 the day before but about 75 percent of its time was still devoted to the large bush. Two females were present most of the time. A second male appeared but was driven off and did not return.

When the male would land on the dorsum of the female, its behavior was quite different than when striking an intruding bee. As it approached the female it would stretch out its legs as for grasping and the female would be seized by them. When striking another bee, the legs were kept tightly under the body and the approach was much faster.

Live bumble bees were attached by a long thread to the end of a stick. To the observer they looked and behaved quite naturally but only occasionally would there be a glancing strike by the male *Anthidium* whether the bumble bees were on a flower or flying. However, if a tethered live bumble bee was dangled two to four inches directly in front of the hovering male, the male could be led for a foot or two but it would not strike. One live bumble bee tied to a flower was closely investigated several times but not struck; most of the time it was ignored.

The male would investigate anything that moved including dangling portions of old flowers but did not strike such objects. It showed only slight aggression against flies and butterflies and these did not show the fear of the male exhibited by the other bee species. The strike against flies and butterflies was usually glancing rather than direct and these insects would usually return to the same or a neighboring flower immediately.

By 6 P.M. the male was spending most of its time visiting flowers. As it approached the flower it would drop its hind legs as does the female.

Observations after September 11 were mostly a repetition of previous observations. The *Caryopteris* bloom was almost gone by the end of September. The last *A. manicatum* noted was seen for a few moments on October 3 about 3 P.M. It was a male and appeared to be the same specimen observed on September 10 and 11.

Observations made in 1965 and 1966 seem to indicate that the male of *A. manicatum* is aggressively territorial. Possibly the easily disturbed timid female needs protection when there is competition for pollen and nectar. Other bees seem to fear the male of *A. manicatum* and never were observed to attempt to defend themselves. Flies and butterflies, although occasionally knocked from flowers, showed no such fear and usually returned to the same or a nearby flower. The male was noted to be most aggressive in bright sunshine during the heat of the day; it is less quick to respond to invasions of its territory as the temperature drops later in the day. Although the male investigates all movement within its territory it does not strike dangling leaves or flowers or bees which are dead or whose movements are inhibited in any way.

It is suggested that further studies of *Anthidium manicatum* in New York are likely to be rewarding. Currently it is not known outside of a limited range in the towns of Ithaca and Lansing in Tompkins County and its pattern of distribution as it spreads will be of interest. No native *Anthidium* is known from New York and one wonders if *A. manicatum* will fit in some unoccupied ecological niche or whether one or more of our native bees may be displaced by this aggressive species. The present population of the species is probably the result of the introduction of a limited number of individuals, possibly of a single nest, so a study of the genetics of the population might be in order. It is of interest in this connection that the color pattern of the males collected in New York run the complete gamut of patterns described from Europe—from mostly yellow with a few black markings to almost completely black. This variation in color pattern is very convenient for the observation of specific individuals.

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Literature Cited

- FABRE, J. HENRI. 1920. Bramble-bees and others. Dodd, Mead and Co., New York. 456 p.
- FRIESE, HEINRICH. 1898. Die Bienen Europa's (Apidae europaeae). IV. Solitare Apiden. C. Lampe, Innsbruck. 304 p.
- GREEN, E. E. 1922. Note on the habits of the bee, *Anthidium manicatum*. Proc. Ent. Soc. London 1921: lxxii-lxxiii.

- HAAS, ADOLPH. 1960. Vergleichende verhaltensstudien zum paarungsschwarm solitarer Apiden. Zeit. Tierpsychol. **17**(4): 402-416.
- JAYCOX, ELBERT R. 1967. An adventive *Anthidium* in New York State (Hymenoptera: Megachilidae). J. Kansas Ent. Soc. **40**(1): 124-126.
- PERKINS, R. C. L. 1928. A note on Mr. Ward's observation on *Anthidium manicatum*. Entomologist **61**(787): 273.
- SITOWSKI, LUDWIK. 1947. [Anthidium, as an exterminator of bees and bumble-bees gathering honey.] Roczn. Nauk. Roln. Lesn. **49**: 434-437. In Polish with an English summary.
- WARD, J. DAVIS. 1928. An unrecorded habit of the male of the bee *Anthidium manicatum* L. Entomologist **61**(787): 267-272.

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